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A NEW SPECIES OF *HANNEMANIA* (ACARINA, TROMBICULIDAE) FROM *BUFO PUNCTATUS* OF WESTERN NORTH AMERICA, WITH COMMENTS ON *HANNEMANIA HYLAE* (EWING).[1]

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ABSTRACT: *Hannemania bufonis*, n. sp. is described from larvae taken off the red spotted toad, *Bufo punctatus* Baird and Girard. The type locality is Whitewater Canyon, Riverside Co., California, and it also is known from Arizona, western Texas, southern Utah and Sonora, Mexico. Closely similar is *Hannemania hylae* (Ewing) redescribed from topotypes taken off the type host, *Hyla cadaverina* Cope (originally listed as *Hyla arenicolor*) from Cottonwood Creek, San Diego Co., California. Additional locality and host records include larvae from *Hyla arenicolor*, taken in Arizona, western Texas, southern Utah, and northern Sonora, Mexico, and off *Hyla cadaverina* from Baja California Norte, Mexico.

INTRODUCTION

Studies of the chiggers from amphibians of southern California revealed two species. One species is *Hannemania hylae* (Ewing) from the California tree frog, formerly *Hyla arenicolor*, later *Hyla californiae* Gorman (1960) and now *Hyla cadaverina* Cope (Duellman, 1968). The second species, which is new, was found on the red spotted toad, *Bufo punctatus* Baird and Girard. Both species are described below and information is given about their known geographic distribution, larval variation and life histories.

The genus *Hannemania* was proposed by Oudemans (1911) and currently is placed in the subfamily Leeuwenhoekinae. The larvae can be distinguished from the larvae of other genera in this subfamily by the presence of a distally expanded flange possessing recurved teeth on the cheliceral blade, and anteromedian projection of the scutum and the lack of stigmata and tracheae. The larvae penetrate the skin of amphibians and become imbedded and encapsulated in the dermis (Hyland, 1961).

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Hannemania bufonis, new species
Figure 1

Types. — Larvae: Holotype and 13 paratopotypes; holotype and 6 paratopotypes from Whitewater Canyon, 4 miles north of Whitewater, Riverside Co., California, host red spotted toad, *Bufo punctatus,* original number WCW670508-5, collected 8 May 1967 by W. C. Welbourn, Jr.; 7 paratopotypes also from Whitewater Canyon from four *Bufo punctatus,* original numbers VPZ660729-5, -7, -15 and -16, taken 29 July 1966 by Virginia P. Zinsmeister.

Diagnosis. — Larva, similar to *Hannemania hylae* in having one genuala II and III, and lacking femoralae and differing from *H. hylae* in having parasubterminala I branched (occasionally nude), tarsala I longer and thinner than tarsala II, PL's laterally peninsulate and long (52-72 in *H. bufonis* and 39-54 in *H. hylae*), AP narrow (17 or less), PW wide (65 or more), PSB 26 or more and with a small ocular plate.

Description of holotype (all measurements in microns, with variations of paratypes in parentheses). Body: fully engorged, 1166 (1034-1200) by 840 (711-840), color in life red to orange; eyes 2/2, equal, red in life, small ocular plate present.

Dorsal setal formula 2-4-8-2-8-8-+9, total 41; measurements of humeral seta 49, setae of first row 38-42, posterior dorsal setae 45-49.

Approximately 60 ventral setae; measurements of sternal seta 36, posterior ventral setae 30-35.

Scutum: punctate, anteromedian projection without puncta; widest between the PL's, being slightly longer than wide, sensilla flagelliform (see figure 1).

Scutal measurements of holotype (with mean and extreme of 13 paratopotypes in parentheses unless otherwise noted). AW 51 (50.4, 47-55, 12), PW 70 (73.5, 65-75), SB 26 (26.5, 25-33), ASB 51 (52.3, 43-56), PSB 31 (28.9, 27-31), AP 15 (14.6, 12-17), AM 36 (34.4, 31-39, 7), AL 40 (35.2, 30-40, 12), PL 64 (62.1, 57-67, 12), S (77.3, 72-87, 6).

Gnathosoma: Cheliceral blade distally expanded with recurved teeth; cheliceral base and capitular sternum punctate. Galeala branched. Palpal setal formula B/B/BNB; palpotarsus with 5 branched setae, and tarsala (10); palpotibial claw trifurcate.

Legs with specialized setae as follows: Leg I, with 4 (3-5) genualae and microgenuala; two tibialae and microtibiala; tarsala 22 (17-22), microtarsala, subterminala, parasubterminala and pretarsala. Leg II, with genuala, two tibialae, tarsala 19 (15-19), microtarsala, and pretarsala. Leg III, coxa with one branched seta; genuala; tibiala and lacking mastisetae. Each leg with 6 punctate segments terminating in

two claws and clawlike empodium, with onychotriches. Leg index: I, 305 (267-327); II, 277 (240-288); III, 270 (252-306); total 852 (768-921).

Taxonomic remarks. — The number of genualae on leg I varies among the larvae of both *Hannemania bufonis* and *H. hylae.* The number and arrangement varies between individuals and on the legs of a single specimen. Examined *H. bufonis* had two to six genualae I with a mean of four, whereas *H. hylae* possessed three to seven genualae I for a mean of 4.9.

The length and width of the ocular plate (when visible) has been used to identify *H. bufonis.* Measurements of ocular plates of *H. bufonis* (type series) revealed a mean length of 22.1 (20-23) and a width of 9 (7-10), whereas the ocular plates of the topotypes of *H. hylae* were 31.5 (30-33) long and 13.3 (12-14) wide.

Tarsala I of *H. bufonis* is longer than tarsala II. The means and extremes for 76 specimens are 20 (17-26) for tarsala I and 17.5 (15-22) for tarsala II. Measurements of the type series (14 specimens) are: tarsala 19.5 (17-22) and tarsala II 17.5 (15-19) and 20 from Arizona are: tarsala I 19.8 (17-22) and tarsala II 17.2 (14-19). The means of the tarsalae of 28 specimens from Texas are slightly larger as tarsala I is 22.8 (20-26) and tarsala II is 19 (18-20). The means are smaller in 13 larvae from Utah as tarsala I is 18.1 (17-22) and tarsala II is 16.3 (15-19).

The parasubterminala I of *H. bufonis* usually has one to four branches although it may be nude. All specimens examined from Sonora, Mexico had a nude parasubterminala. In eight type specimens of *H. bufonis* the branched parasubterminala I 20.6 (19-22) was nearly as long as the subterminala I 21 (20-22) and in four types the nude parasubterminala I was 19 (18-20) and the subterminala I was 20.2 (19-21). However the parasubterminala was always nude in *H. hylae.* In ten specimens of *H. hylae* the parasubterminala I was 15.6 (14-16) and the subterminala I was 19.5 (19-20).

Ecological notes. — *Hannemania bufonis* has been taken only from *Bufo punctatus.* The chigger was embedded in the ventral dermis especially of the belly and hind legs. Larvae are also found on the dorsum, even in the dermis of the parotoid gland of one toad.

In California, toads with *H. bufonis* usually were associated with rocks and boulders. However, in Texas the hosts were taken in low rolling hills apparently devoid of large rocks.

Numerous engorged larvae of *H. bufonis* from California and Texas have been reared to nymphs and adults, and it was observed that they passed from the engorged larval stage to the adult stage without the

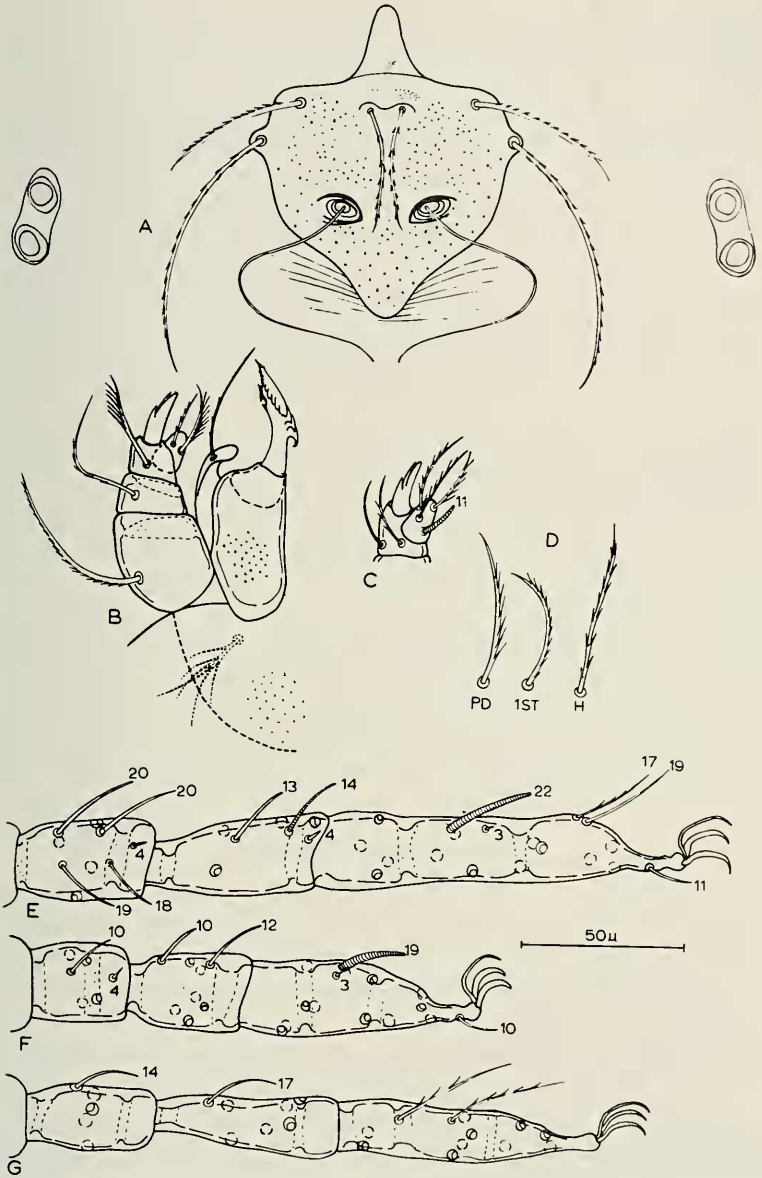

Figure 1. Hannemania bufonis, n. sp. A. Scutum and eyes; B. Dorsal view of gnathosoma; C. Ventral aspect of palpotibia and tarsus; D. Representative body setae, 1St, first sternal, H, hymeral and PD, posterior dorsal; E. Leg I; genu, tibia and tarsus with nude setae and bases of branched setae, with measurements in microns; F. Leg II; G. Leg III.

active nymphs feeding. Each of ten engorged larvae from the Granite Mountains, San Bernardino Co., California was placed into an individual culture. After 31 days without food, seven were adults, two were in the imagochrysalis stage and only one was still an active nymph.

This rapid development probably shortens the life cycle from engorged larva to freeliving unfed larva, which may be correlated with the availability of the host toads.

Specimens examined. — Total 272 larvae all from *Bufo punctatus*: ARIZONA, *Mohave Co.*: Grand Canyon National Mon., Toroweap Valley, 25 April 1943 (17). *Pima Co*: 9 mi. N Vail, 9 April 1963 (26); Organ Pipe Cactus National Mon, 1 mi. S Headquarters in campground, 12 Aug. 1963 (10); and Quitobaquito, 7 July 1956 (25). CALIFORNIA, *Riverside Co.,* Joshua Tree National Mon.: Barker Dam, 5 Aug. 1965 (4), Squaw Tank, 12 Oct. 1962 (4), Whitetank Campground, 4 Nov. 1963 (8). *Riverside Co.*: Whitewater Canyon, 1.5 to 4 mi. N Whitewater, 17 April 1965 (3), 3 July 1966 (25), 29 July 1966 (66). *San Bernardino Co.*: Dripping Springs, Granite Mts., 17 mi. NNE Amboy, 13 Oct. 1968 (11); Joshua Tree National Mon., Fortynine Palms Oasis, 28 Aug. 1963 (4) and Indian Cove, 11 April 1960 (11). TEXAS, *Culberson Co.*: 18-21 mi. SE Whites City, New Mexico, 13 July 1968 (26); 28 mi. SE Whites City, New Mexico, 14 July 1968 (8). *Brewster Co.*: 1.8 mi. E Lajitos, 20 July 1968 (1). UTAH, *Washington Co.*: Hurricane, 21 May 1941 (1); Snow Canyon, 15 June 1967 (16). *MEXICO,* SONORA: 8 mi. S Alamos, 6 April 1966 (4); road between La Aduana and Minas Nuevas Aug. 1968 (2).

Hannemania hylae (Ewing)
(Figure 2)

Trombicula hylae Ewing, 1925, Proc. Ent. Soc. Wash. 21(7): 146. Holotype from *Hyla arenicolor* (= *Hyla cadaverina* Cope), Barrett Dam, Cottonwood Creek, San Diego Co., California, 15 March 1925 by L. M. Klauber.

Hannemania hylae, Ewing, 1931, Proc. U. S. Natl. Mus. 80(8): 4; Gould, 1956, Univ. Calif. Publ. Ent. 11: 25-26.

Diagnosis. — Larva similar to *H. bufonis* in having one genuala on legs II and III and lacking femoralae and differing from *H. bufonis* in having parasubterminala I nude, tarsala I subequal to tarsala II, PL short (less than 55), AP wide (17 or more), PW less than 65, PSB less than 26, and, with a large ocular plate.

Description of species (based on 21 topotypes from Cottonwood Creek, near Barrett Dam, San Diego Co., from 3 *Hyla cadaverina* col-

lected 10 March 1968 by W. C. Welbourn, Jr.). Body: Fully engorged, 900 (900-1100) by 480 (480-660), color in life red to orange; eyes 2/2, subequal, red in life, large ocular plate present.

Dorsal setal formula 2-4-8-2-8-+24, total 48; measurements of humeral seta 42, setae of first row 33-37, posterior dorsal setae 34-41.

Approximately 46 ventral setae, measurements of sternal seta 30, posterior ventral seta 24-30.

Scutum: punctate except for anteromedian projection, sensilla flagelliform (see figure 2).

Scutal measurements of 21 specimens (unless otherwise noted) with mean and extreme, AW 47 (44-49, 20), PW, 62.2 (59-65, 14), SB 25.2 (23-29), ASB 52.6 (50-55, 8), PSB 24 (23-25, 15), AP 19.5 (17-21, 10), AM 26.6 (24-30, 17), AL 31 (28-34, 18), PL 44.1 (39-49, 15), S 70 (68-78, 8).

Gnathosoma: Cheliceral blade distally expanded with recurved teeth; cheliceral base and capitular sternum punctate. Galeala branched. Palpal setal formula B/B/BNB; palpotarsus with 5 branched setae and tarsala (12); palpotibial claw trifurcate.

Legs with specialized setae as follows: Legs I, with three to seven genualae and microgenuala; two tibialae and microtibiala; tarsala 20.6 (19-23), microtarsala, subterminala, parasubterminala and pretarsala. Leg II, with genuala and microgenuala; two tibialae; tarsala 21.8 (20-23), microtarsala, and pretarsala. Leg III, coxa with one branched seta; genuala; tibiala and lacking mastisetae. Each leg with six punctate segments, terminating in two claws and clawlike empodium, with onychotriches. Leg index: I, 313 (270-336); II, 272 (280-300); III, 292 (272-324), total 877 (782-960).

Of 117 specimens measured, the means and extremes of tarsala I are 19.8 (17-23) and tarsala II are 21.9 (18-28). 'Measurements of tarsala I from each area are: 20.6 (19-23), 21 topotypes; 19.5 (18-21), 16 from Arizona; 18.4 (17-20), 20 from Utah; 20.1 (17-24), 40 from Texas; and 19.6 (18-22), 20 from Sonora, Mexico. Measurements of tarsala II are: 21.8 (20-23), 21 topotypes; 21.4 (18-24), 16 from Arizona; 21.1 (20-22), 20 from Utah,; 20.1 (17-24), 40 from Texas; 22.3 (21-24), 20 from Sonora, Mexico.

Ecological notes. — *Hannemania hylae* parasitizes *Hyla cadaverina* in southern California and northern Baja California, Mexico whereas it infests *Hyla arenicolor* from Arizona, west Texas, southern Utah and northern Sonora, Mexico. This chigger usually is found on tree frogs taken from rocky canyons with permanent springs or streams flowing through semi-arid lands. *Hannemania hylae* usually was found in the ventral dermis of the legs and belly as noted by Ewing (1926).

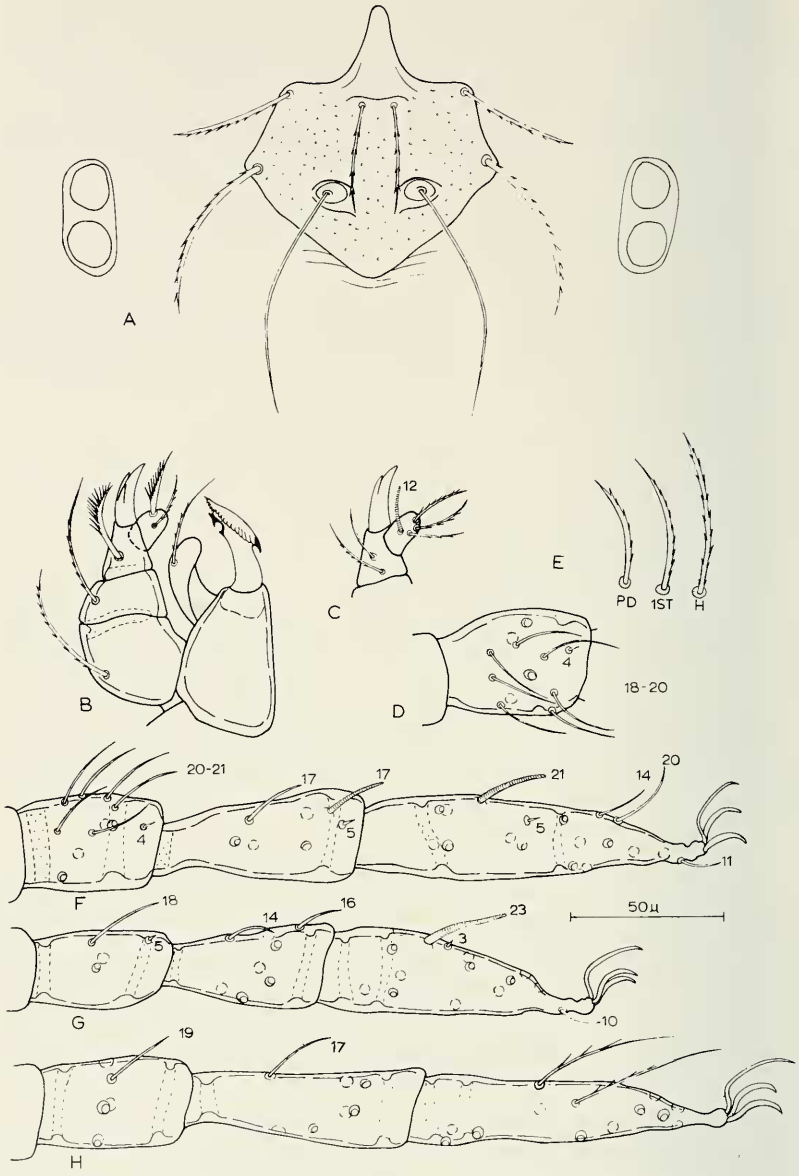

Figure 2. Hannemania hylae (Ewing). A. Scutum and eyes; B. Dorsal view of gnathosoma; C. Ventral aspect of palpotibial and tarsus; D. Genu with seven genualae; E. Representative body setae, 1St, first sternal, H, humeral and PD, posterior dorsal; F. Leg I; genu, tibia and tarsus with nude setae and bases of branched setae, with measurements in microns; G. Leg II; H. Leg III.

Many engorged larvae have been reared to the nymphal and adult stages, and in every case the nymph fed prior to transforming into the adult. Cultured engorged larvae transformed into nymphs within two weeks (as did *H. bufonis*) but they remained active nymphs until they died or were fed enough collembola eggs to transform into the adult stage.

Specimens examined: Total 319 larvae: ARIZONA, all from *Hyla arenicolor*; *Coconino Co.*: Clear Creek Canyon, 10 Sept. 1965 (6); *Cochise Co.*: Chiricahua Mountains, South fork of Cave Creek, 25 July 1968 (1); *Pima Co.*: Bear Canyon, 1.5 mi. E Sabino Canyon Visitor Center, 20 March 1967 (24); Madera Canyon, 1 mi. N Madera Canyon lodge, 26 July 1968 (32). CALIFORNIA, all from *Hyla cadaverina*: *Orange Co.*: Harding Canyon, 20 Feb. 1966 (8), 25 April 1964 (8); Silverado Canyon, 28 June 1967 (2); *Riverside Co.*: Tahquitz Canyon, 24 Feb. 1968 (34); Whitewater Canyon, 5 mi. N Whitewater, 30 March 1962 (6). *San Bernardino Co.*, Joshua Tree National Mon.: Fortynine Palms Oasis, 23 Sept. 1961 (2), 28 Aug. 1963 (20), 20 Sept. 1967 (19), 26 April 1968 (4); Indian Cove, 11 April 1960 (11). *San Diego Co.*: Anza-Borrego State Park, Palm Canyon, 25 June 1967 (41); Indian Flats Campground, 4 mi. N, 2 mi. W Warner Springs, 16 June 1967 (6). TEXAS, *Jeff Davis Co.*: 4 mi. W, 5 mi. N Fort Davis, 16-17 July 1968, *Hyla arenicelor* (40). UTAH, *Washington Co.*: Zion National Park, Narrows trail, Virgin River, 10 Sept. 1967, *Hyla arenicolor* (20). *MEXICO,* BAJA CALIFORNIA NORTE: 5 mi. E Cerro del Castillo, 30 March 1961, *Hyla cadaverina* (10). SONORA, all from *Hyla arenicolor,* 5 mi. NW Cananea, 3 April 1966 (10); 11 mi. E Imuris, 3 April 1966 (15).

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Literature Cited

Duellman, W. E., 1968. The taxonomic status of some American hylid frogs. *Herpetologica* 24: 200.

Ewing, H. E., 1925. Two chiggers (*Trombicula* larvae). *Proc. Ent. Soc. Wash.* 21: 146.

Ewing, H. E., 1926. The life history and biology of the tree-toad chigger, *Trombicula hylae* Ewing. *Ann. Ent. Soc. Amer.* 29: 261-267.

Ewing, H. E., 1931. A catalogue of the Trombiculinae of chigger mites, of the New World with new genera and species and a key to the genera. *Proc. U. S. Natl. Mus.* 80: 1-19.

Gorman, J., 1960. Treetoad studies, I. *Hyla californiae,* new species. *Herpetologica* 16: 214-222.

Gould, D. J., 1956. The larval trombiculid mites of California (Acarina: Trombiculidae). *Univ. Calif. Publ. Ent.* 11: 1-116.

Hyland, K. E., 1961. Parasitic phase of chigger mite, *Hannemania hegeneri* on experimentally infested amphibians. *Exp. Parasit.* 11: 212-225.

Oudemans, A. C., 1911. Acarologische Aanteekeningen XXXVI. *Entomologie Bericht. Amsterdam* 3: 137-139.

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